Hugh Boyd

# The reported kill of ducks and geese in Canada and the USA, 1974–82

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Service canadien de la faune

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# Contents


| | |
|---|---|
| 5 | Acknowledgements |
| 5 | **Abstract** |
| 6 | **Introduction** |
| 7 | **Results** |
| 7 | 1. Total reported kill and hunting effort |
| 9 | 2. Kill of individual species |
| 11 | 3. Regional changes in hunting in Canada |
| 12 | 4. Management issues |
| 12 | 4.1. Declining hunting effort and changing success |
| 13 | 4.2. Fewer ducks per hunter |
| 14 | 4.3. How long can the goose-harvest boom last? |
| 14 | 4.4. Harvest by native people |
| 14 | 4.5. Are the NHS data adequate? |
| 18 | **Concluding comments** |
| 20 | **Literature cited** |

**List of tables**

| | |
|---|---|
| 8 | Table 1. Reported kill of major groups of ducks and geese in Canada and USA, 1974–75 to 1982–83 |
| 9 | Table 2. Reported kill of geese in Canada and USA, 1974–75 to 1982–83 |
| 10 | Table 3. Levels and trends in kill of species of ducks in Canada and USA, 1974–75 to 1982–83 |
| 12 | Table 4. Mean annual rates of change in waterfowl hunting activity and kill in major regions of Canada, 1974–75 to 1982–83 |
| 13 | Table 5. Mean annual rates of change in waterfowl hunting activity and kill in Canadian regions and in US flyways, 1974–75 to 1982–83, and mean kills in 1982–83 |
| 14 | Table 6. Estimates of mean annual kill of waterfowl by Canadian Indians and Inuit compared with kill by other Canadians, 1974–77 and 1978–82, and with American sport kill |
| 15 | Table 7. Numbers of waterfowl hunters in provinces of Canada active in 1981 estimated from NHS and Statistics Canada survey |
| 16 | Table 8. Estimates of total number of days on which people hunted in provinces of Canada in 1981, and average number of days on which each respondent hunted, from NHS and Statistics Canada survey |
| 16 | Table 9. Percentage of active hunters who claimed success in bagging one or more ducks or geese in 1981, from NHS and Statistics Canada survey |
| 16 | Table 10. Estimates of provincial waterfowl kill in 1981 derived from numbers of hunters identified in Statistics Canada wildlife survey |
| 17 | Table 11. Estimates from Saskatchewan Hunter and Game Population Survey and NHS of numbers of active and successful waterfowl hunters in Saskatchewan, 1978–82 |
| 17 | Table 12. Estimates of kill and ducks and geese in Saskatchewan in 1975–82 derived from Saskatchewan Hunter and Game Population Survey and NHS |

**List of figures**

| | |
|---|---|
| 7 | Figure 1. Estimates of ducks killed in Canada and USA, 1974–75 to 1982–83 |
| 8 | Figure 2. Estimates of retrieved kill of geese in Canada and USA, 1974–75 to 1982–83 |

| | |
|---|---|
| 8 | Figure 3. Average seasonal bags of ducks and geese per active hunter in Canada and USA, 1974–75 to 1982–83 |
| 9 | Figure 4. Canadian duck-hunting effort and kill as percentage of total in Canada and USA, 1974–75 to 1982–83 |
| 9 | Figure 5. Canadian kill of geese as percentage of total in Canada and USA, 1974–75 to 1982–83 |
| 11 | Figure 6. Estimates of waterfowl hunting effort in regions of Canada, 1974–75 to 1982–83 |
| 11 | Figure 7. Estimates of regional kill of ducks in Canada, 1974–75 to 1982–83 |
| 12 | Figure 8. Estimates of regional kill of geese in Canada, 1974–75 to 1982–83 |
| 12 | Figure 9. Percentages of active hunters in Prairie Provinces taking ducks only, geese only, both ducks and geese, or neither, 1974–75 to 1982–83 |
| 13 | Figure 10. Regional kill of ducks in Canada, 1974–75 to 1982–83 |
| 15 | Figure 11. Alternative estimates of the kill of ducks and geese in the provinces of Canada in 1981, from NHS and from Statistics Canada estimates of hunter numbers and activity |

**List of appendices**

| | |
|---|---|
| 19 | Appendix 1. List of scientific names of geese and ducks referred to by vernacular names in the text |

# Abstract

**Acknowledgements**

The Canadian Wildlife Service is greatly indebted to the thousands of waterfowl hunters who have responded to the National Harvest Surveys since their inception, and so made possible this and many other studies of their activities and of changes in waterfowl populations.

I am indebted to F.G. Cooch, F. Filion, A.J. Macaulay, J.H. Patterson, and J.S. Wendt for comments on a first draft and to S.V. Briggs for suggesting improvements to the final version. D. Saliga succeeded in producing clean copy from a difficult manuscript, for which I am most grateful.

National Harvest Surveys (NHS) and Species Composition Surveys (SCS) conducted annually in the USA and Canada make it possible to estimate the retrieved kill of waterfowl by hunters buying Migratory Bird Hunting Stamps (Duck Stamps) in the USA and Migratory Game Bird Hunting Permits in Canada. In the nine seasons from 1974–75 to 1982–83 the combined retrieved kill of ducks averaged 17.3 million (3.55 million, 20.5%, taken in Canada), ranging from 14.6 million in 1982–83 to 19.4 million in 1976–77. The average combined kill of geese was 2.3 million (580 000, 25.1%, in Canada), ranging from 1.9 million in 1974–75 to 2.5 million in 1980–81. Appreciable but incompletely known numbers of ducks and geese are taken by native people without permits, and by hunters acting illegally, so that the reported estimates are well below the total yearly kill, which may be as high as 23 million ducks and 3 million geese.

A special inquiry by Statistics Canada, using the Labour Force Survey sampling framework, indicated that in 1981, 658 000 Canadians claimed to have hunted waterfowl, though only 347 000 (52.8%) bought Migratory Game Bird Hunting Permits that year. Similar comparisons between two types of surveys in the USA indicated that in 1980 active hunters buying Duck Stamps represented only 30.4% of the people claiming to have hunted waterfowl. Estimates of waterfowl hunters' activity and kill from the (provincial) Saskatchewan Hunter and Game Population Survey agree well with those from the NHS. Other independent assessments of the scale of waterfowl hunting in Canada are needed.

# Introduction

Estimates of the legal kill of waterfowl in Canada and the USA are obtainable, thanks to the requirement in each country that a would-be waterfowl hunter should have an annual federal licence—the US Migratory Bird Hunting Stamp (Duck Stamp) or the Canadian Migratory Game Bird Hunting Permit (MGBH Permit). The licence or permit sales records themselves provide indices of hunting activity, although appreciable numbers of buyers do not in the event go hunting, and in Canada Indians and Inuit (as defined in the Indian Act) are exempt from the requirement to hold a MGBH Permit. There are some hunters who fail to buy the appropriate federal licence and who, in Canada, may or may not buy the provincial licence(s) that are also obligatory.

The buyers of MGBH Permits or Duck Stamps provide the sampling frame for the National Harvest Survey (NHS) and Species Composition Survey (SCS) undertaken annually in each country, separate groups of hunters being selected for each survey. The sampling rationale and procedures and the reliability of the estimates obtained in Canada were described by Cooch *et al.*(1978). Martin and Carney (1977) described the US surveys, and Couling *et al.* (1982) investigated their reliability. Estimates of reported kill are relatively precise at the national level and for ducks and geese as a whole, though less reliable for small areas and for species forming only a small fraction of the kill. The numbers estimated are of ducks and geese retrieved and reported.

In the USA a second estimate, involving the addition of about 20% of the total duck kill and 14% of the total goose kill, is made to allow for waterfowl killed but not retrieved. No such adjustment is made routinely in Canada. The proportions of birds knocked down and lost vary regionally and according to the kind of shooting being done—in fields, in marshes, at small ponds or large lakes, in estuaries, or offshore.

The native kill of geese is large on both the Ontario and Quebec shores of James Bay (see section 4.4) and appreciable in a few other areas, though in general native subsistence hunters are more interested in taking mammals. The only ducks they take in important numbers are eiders, especially in northern Quebec and the eastern Arctic. There are widespread misconceptions about the scale of native hunting in Canada, fostered by distrust and disapproval of practices in different cultures, and by recent evidence of intensive hunting by natives in Alaska (Raveling 1984).

The scale of illegal hunting is poorly known, but also subject to regional and cultural variation. In the Atlantic Provinces and along the Quebec shores of the Gulf of St. Lawrence (Blanchard 1984), long traditions of waterfowl shooting in spring have persisted since the practice was outlawed by the Migratory Birds Convention Act in 1917, though increased enforcement has reduced the amount of illegal hunting, especially in the Maritimes, in recent years. Shooting in late summer, before the opening of the hunting season, is also fairly widespread.

Thus the estimates of kill used in this report are substantially less than the total kill. Until very recently, the Canadian NHS failed to sample hunting in January, which is limited to the Atlantic and Pacific coasts and to the relatively few species that winter there in abundance. The relative abundance of different species in the kill in September–December, determined by the SCS, should be without serious bias.

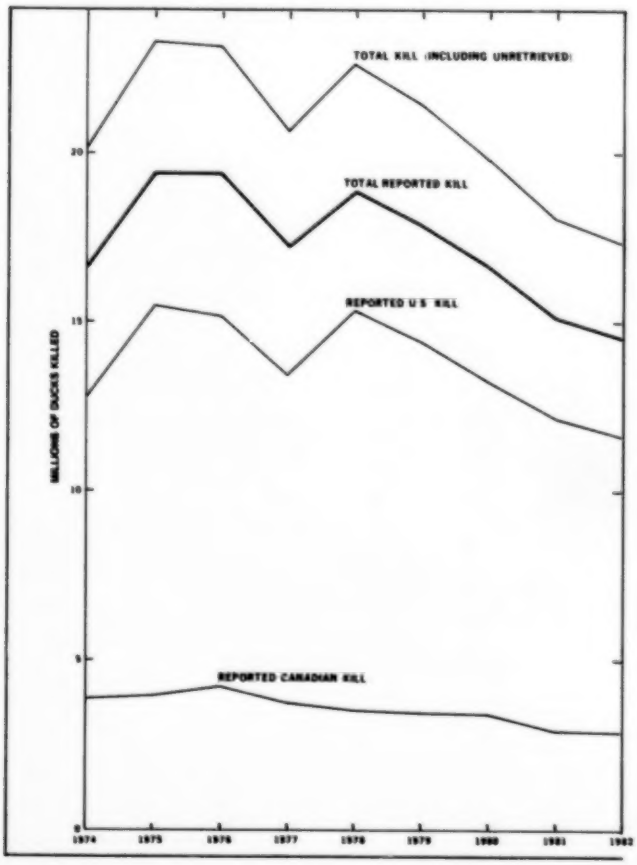
In this report, attention is concentrated on the nine seasons from 1974–75 to 1982–83, during which the US and Canadian harvest survey systems were operating in standardized and well understood ways. It seems inappropriate to pay much attention to events of more than a decade ago or to engage in sophisticated manipulation of these short runs of data. The data are presented in summary tables, graphs being used to draw attention to trends and inter-specific or regional differences. The sequence used is: (1) combined kill in both countries, (2) kill in Canada, (3) kill in the USA, (4) regional kill in Canada. No more attention is paid to regional differences within the USA than is sufficient to elucidate international differences. More detailed records are published in the Canadian Wildlife Service (CWS) Progress Notes and in US Fish and Wildlife Service (USFWS) Waterfowl Status Reports.

# Results

## 1. Total reported kill and hunting effort

In the nine seasons from 1974–75 to 1982–83, the seasonal mean reported kill of ducks was 3.55 ± 0.41 million (20.5%) in Canada and 13.76 ± 1.34 million in the USA—17.31 ± 1.65 million in all—with a combined peak of 19.4 million in 1976–77 and a low of 14.6 million in 1982–83 (Table 1). The reported kill of ducks declined by an average of 2.5% annually, by 4.0% in Canada and by 2.1% in the USA (Fig. 1). (In this and all subsequent references to trends, whether expressed as % annual change or more directly, the slope of the linear regression is significantly different from zero, with $p<0.10$.)

**Figure 1**
Estimates of ducks killed in Canada and USA, 1974–75 to 1982–83, in millions




The average numbers of geese reported killed and retrieved were 580 000 ± 90 000 (25.1%) in Canada and 1 720 000 ± 190 000 in the USA—2.3 ± 0.16 million in all—varying from 1.9 million in 1974–75 to 2.5 million in 1980–81 (Table 2). The kill of geese increased by an average of 4.2% in Canada and showed no clear trend in the USA, with a combined rate of increase of 1.3% annually (Fig. 2).

The numbers of MGBH Permit buyers actively hunting waterfowl in Canada averaged 382 000 ± 22 000, peaking at 413 000 in 1977 and falling to 348 000 in 1981–82, with no statistically significant trend over the whole period. The average number of Duck Stamp buyers active in the USA was 1 682 000 ± 135 000, decreasing from 1 854 000 in 1975 to 1 439 000 in 1983, at a mean rate of 2.9% per annum. Because of the predominance of Americans (81.5% of the combined total), there was a decline in the combined hunter population at an annual rate of 2.5%.

Canadian waterfowl hunters averaged 3.0 ± 0.13 million hunter-days each year, 16.8% of the continental total of 17.9 ± 2.0 million; an average of 7.9 days per active hunter, compared with 8.8 days per US hunter. In both countries the annual number of days spent waterfowl hunting increased in the early 1970s but then fell, giving a significant trend for the period as a whole of –28 000 days a year (–0.94%) in Canada and –323 000 days (–2.16%) in the USA. Waterfowl hunting in Canada peaked in 1978, at 3.22 million hunter-days. In the USA the greatest activity during the period was in 1975–76, 16.38 million hunter-days. In 1982–83 it was only 13.2 million, a fall of 19.3% in 7 years.

Because of the way in which the US data are collected, we cannot estimate how much of the American waterfowl hunting effort was aimed primarily at geese, so that for comparison between countries the total effort has to be used, which exaggerates the disparity between the average seasonal kills of ducks and of geese. Figure 3 shows that the average kill of ducks by each active hunter in Canada fell from 10.5 in 1974 to 8.1 in 1982, while in the USA it rose from just over 7 to 8.1, effectively offsetting the reduction in Canada. The average individual kill of geese increased in both countries, from 1.12 to 1.76 in Canada and from 0.84 to 1.16 in the USA, with a mean increase of 0.94 to 1.3, a gain of 38%, or 4.8% annually.

The combined effect of these several trends on the Canadian share of the waterfowl harvest is shown in Figures 4 and 5. Although Canadian hunting activity increased as a proportion of the total, from 16% of hunter-days in 1974–75 to 18% in 1982–83, and the share of the goose kill increased from 22% to 28%, the Canadian share of the duck kill fell from 23% to 20%.

**Figure 2**
Estimates of retrieved kill of geese in Canada and USA, 1974–75 to 1982–83, in millions

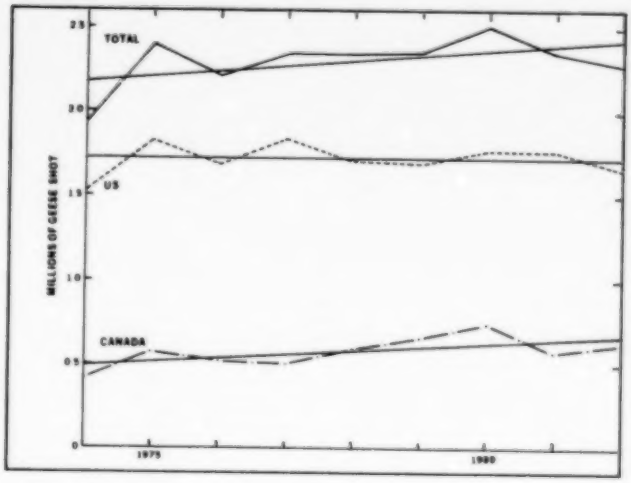



**Figure 3**
Average seasonal bags of ducks (upper) and geese (lower) per active hunter in Canada and USA, 1974–75 to 1982–83

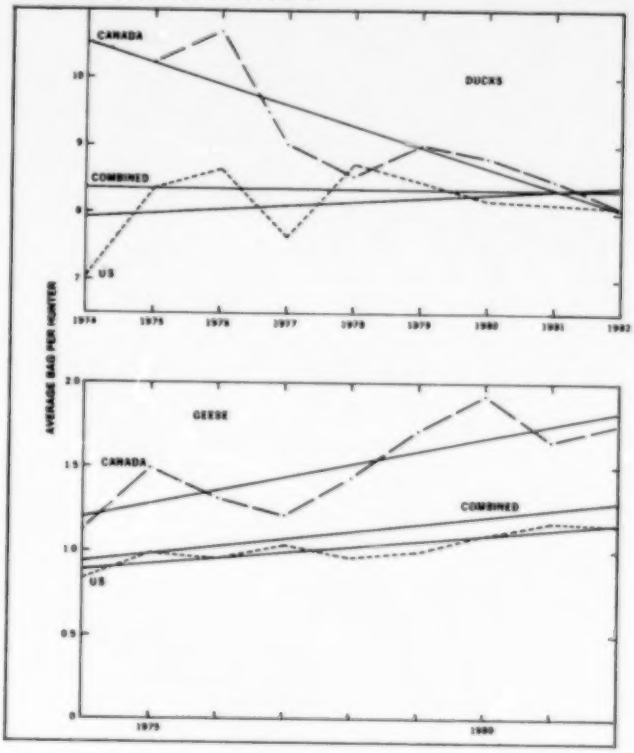



**Table 1**
Reported kill of major groups of ducks in Canada and USA, in 1974–75 to 1982–83, in thousands, with trends in form of mean annual change as % of period mean. Only trends significant at 10% level are entered in this and subsequent tables

| Species/groups | | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | Mean | % annual change |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mallard | Canada | 1 801 | 1 744 | 1 952 | 1 565 | 1 529 | 1 612 | 1 534 | 1 294 | 1 214 | 1 583 | –4.7 |
| | USA | 4 515 | 5 015 | 5 021 | 4 468 | 5 066 | 4 816 | 4 683 | 4 367 | 3 883 | 4 648 | –1.7 |
| | Total | 6 316 | 6 759 | 6 973 | 6 033 | 6 595 | 6 428 | 6 217 | 5 661 | 5 097 | 6 231 | –2.1 |
| Black Duck | Canada | 308 | 303 | 344 | 360 | 379 | 317 | 365 | 326 | 337 | 338 | — |
| | USA | 387 | 363 | 432 | 274 | 337 | 299 | 397 | 290 | 234 | 335 | –4.3 |
| | Total | 695 | 666 | 775 | 634 | 716 | 616 | 762 | 616 | 571 | 673 | — |
| Other dabblers | Canada | 866 | 953 | 975 | 906 | 791 | 692 | 634 | 527 | 604 | 772 | –7.0 |
| | USA | 5 139 | 6 928 | 6 563 | 5 659 | 5 915 | 6 323 | 5 374 | 4 352 | 4 914 | 5 685 | –3.0 |
| | Total | 6 005 | 7 581 | 7 538 | 6 565 | 6 706 | 7 015 | 6 008 | 4 879 | 5 518 | 6 457 | –3.5 |
| Wood Duck | Canada | 95 | 102 | 110 | 128 | 143 | 114 | 118 | 124 | 117 | 117 | — |
| | USA | 971 | 1 206 | 1 061 | 1 027 | 1 275 | 1 251 | 1 395 | 1 364 | 1 154 | 1 189 | 2.9 |
| | Total | 1 066 | 1 308 | 1 171 | 1 155 | 1 418 | 1 365 | 1 513 | 1 488 | 1 271 | 1 306 | 3.4 |
| Aythyini (pochards) | Canada | 398 | 436 | 421 | 366 | 331 | 368 | 403 | 324 | 322 | 374 | –3.0 |
| | USA | 1 142 | 1 285 | 1 445 | 1 438 | 1 130 | 1 094 | 1 028 | 1 221 | 910 | 1 188 | –3.2 |
| | Total | 1 540 | 1 721 | 1 866 | 1 804 | 1 461 | 1 462 | 1 428 | 1 545 | 1 232 | 1 562 | –3.2 |
| Ruddy Duck | Canada | 5 | 5 | 7 | 4 | 1 | 8 | 3 | 3 | 3 | 4 | — |
| | USA | 64 | 76 | 83 | 39 | 64 | 73 | 48 | 45 | 48 | 60 | –5.4 |
| | Total | 69 | 81 | 90 | 43 | 65 | 81 | 51 | 48 | 51 | 64 | –5.5 |
| Mergini (sea ducks) | Canada | 399 | 378 | 403 | 402 | 348 | 327 | 346 | 340 | 306 | 359 | –2.8 |
| | USA | 391 | 445 | 412 | 421 | 431 | 393 | 388 | 399 | 344 | 405 | –1.7 |
| | Total | 790 | 823 | 815 | 823 | 779 | 720 | 734 | 739 | 650 | 764 | –2.4 |
| Total ducks | Canada | 3 855 | 3 921 | 4 213 | 3 729 | 3 522 | 3 457 | 3 403 | 2 959 | 2 904 | 3 551 | –4.0 |
| | USA | 12 797 | 15 483 | 15 191 | 15 354 | 15 354 | 14 415 | 13 252 | 12 194 | 11 671 | 13 759 | –2.1 |
| | Total | 16 652 | 19 404 | 19 404 | 17 199 | 18 876 | 17 872 | 16 655 | 15 153 | 14 575 | 17 310 | –2.5 |

**Figure 4**
Canadian duck-hunting effort and kill as percentage of total in Canada and USA, 1974–75 to 1982–83

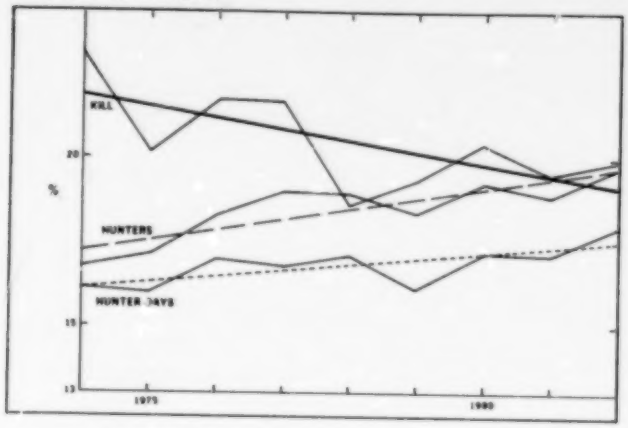
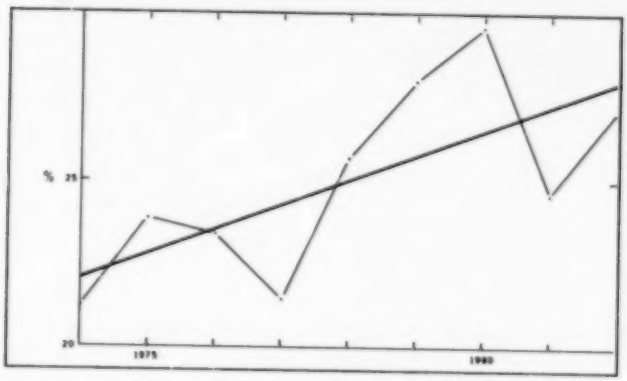



**Figure 5**
Canadian kill of geese as percentage of total in Canada and USA, 1974–75 to 1982–83




## 2. Kill of individual species

The abridged list of ducks in Table 1 suggested that during 1974–82 the kill of most groups was falling, the increased kill of Wood Ducks providing the sole exception. Table 3 lists all the species for which separate estimates are available. (Scientific names are listed in Appendix 1.) In the USFWS harvest listings no specific distinctions are drawn between the three species of scoter (*Melanitta* spp.), the Common and Red-breasted Mergansers, or the Common and Barrow's Goldeneyes. In the CWS surveys those species providing very few wings (or tails of geese), and consequently small and unreliable estimates of kill, have been omitted from some previously published tabulations and will be ignored here. Table 3 lists all the species identified in the two SCS and shows those with significant trends over the entire period in each country and in both.

For six of the eight dabbling ducks, the Canadian kill averaged about one-eighth (11.2–13.0%) of the total, these including the Green-winged Teal, American Wigeon, and Pintail, most of which breed in the north, as well as the more southern Gadwall and Blue-winged Teal. For five of those six the Canadian kill declined significantly. Only the Shoveler and Pintail showed declines in the USA, and at a lower rate. There were also decreases in both countries in the kill of the Mallard, by far the largest contributor to the kill, comprising 58.8% of the dabbling ducks and 44.6% of all ducks killed in Canada, 43.6% of the dabbling ducks and 33.8% of all ducks killed in the USA, and 36.2% of the combined duck kill. The Black Duck is unique amongst the dabblers, the Canadian kill having recently come to exceed 50% of the total, due to a decline in the US kill.

The Wood Duck provided 7.6% of the total duck kill, relatively few being taken in Canada, where it is largely a late-summer immigrant rather than a breeding bird. The US kill has grown rapidly, that in Canada less clearly.

**Table 2**
Reported kill of geese in Canada and USA, 1974–75 to 1982–83, in thousands

| Species/groups | | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | Mean | % annual change |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Canada | Canada | 322 | 362 | 301 | 343 | 406 | 432 | 462 | 364 | 409 | 378 | 3.7 |
| | USA | 954 | 1039 | 1064 | 1178 | 1216 | 1007 | 1178 | 1048 | 1080 | 1085 | — |
| | Total | 1276 | 1401 | 1395 | 1521 | 1622 | 1439 | 1640 | 1412 | 1489 | 1463 | 1.5 |
| Greater Snow | Canada* | 10 | 36 | 27 | 21 | 13 | 22 | 55 | 30 | 42 | 34 | — |
| | USA† | X | 10 | 17 | 22 | 20 | 28 | 27 | 14 | 23 | 20 | 13.8 |
| | Total | 10 | 46 | 44 | 43 | 63 | 50 | 82 | 44 | 65 | 55 | 5.2 |
| Lesser Snow | Canada | 56 | 106 | 95 | 78 | 78 | 137 | 140 | 129 | 117 | 104 | 7.4 |
| | USA | 470 | 619 | 483 | 516 | 354 | 538 | 432 | 462 | 392 | 474 | — |
| | Total | 526 | 725 | 578 | 594 | 432 | 675 | 572 | 591 | 509 | 578 | — |
| Ross' | Canada | 5.1 | 6.8 | 5.0 | 1.1 | 1.8 | 8.3 | 1.8 | 3.1 | 1.5 | 3.1 | — |
| | USA | 8.6 | 7.2 | 9.7 | 1.5 | 2.4 | 6.6 | 3.8 | 9.7 | 13.8 | 7.4 | — |
| | Total | 13.7 | 14.0 | 14.7 | 8.6 | 7.2 | 14.9 | 8.6 | 12.8 | 18.3 | 12.4 | — |
| White-fronted | Canada | 52 | 63 | 62 | 58 | 62 | 61 | 79 | 52 | 51 | 60 | — |
| | USA | 140 | 116 | 102 | 103 | 116 | 108 | 124 | 199 | 128 | 120 | 6.4 |
| | Total | 192 | 179 | 164 | 161 | 178 | 169 | 203 | 251 | 179 | 180 | 4.2 |
| Atlantic Brant | Canada | — | — | — | 0.1 | — | 0.1 | 3.1 | — | — | — | — |
| | USA† | X | 33.4 | X | X | X | X | X | 33.7 | 24.2 | — | — |
| Pacific Brant | Canada | 0.4 | — | 0.2 | — | — | — | 0.3 | — | — | — | — |
| | USA | 5.0 | 3.3 | 2.9 | 12.1 | 2.3 | 3.4 | 3.3 | 1.9 | 1.3 | — | — |
| | Total‡ | 5.4 | 3.3 | 3.1 | 12.1 | 2.3 | 3.4 | 3.6 | 1.9 | 1.3 | 3.3 | — |
| All geese retrieved | Canada | 414 | 575 | 520 | 504 | 594 | 660 | 745 | 580 | 622 | 579 | 4.2 |
| | USA | 1526 | 1828 | 1692 | 1840 | 1713 | 1694 | 1771 | 1171 | 1663 | 1722 | — |
| | Total | 1940 | 2403 | 2212 | 2344 | 2307 | 2354 | 2516 | 2351 | 2285 | 2301 | 1.3 |

*Means and trends 1975–82 only. †X = season closed. ‡Great majority of kill in Mexico, not estimated.

Among the five species of Aythyini (pochards) Canada took 42.0% of the northern Greater Scaup and 20–27% of the others. Only the kill of Canvasbacks showed a general decline, though the Canadian kill of both scaups fell, as did the American kill of Ring-necked Ducks (many of which breed relatively far south into the eastern USA).

Few Canadians report shooting Ruddy Ducks, so that the annual estimates of kill are of low reliability and add little to the US records, which show a marked decline.

Canadians kill more sea ducks than do Americans, because most sea ducks both breed and winter further north than other ducks. Duck hunting at sea in winter is a harsh form of recreation attracting relatively few practitioners. Thus the bulk of the sea ducks killed (other than eiders) are taken inland, on breeding areas, or while on passage across southern Canada and the northern USA. In contrast to other groups, the US scoter kill diminished substantially. The Canadian scoter kill showed less clear reductions, though all three species tended to be reported less often after 1977–78, perhaps as the result of hard-weather losses in the east in 1977. The NHS estimate of eider kill in Canada is undoubtedly much too low, because the winter kill in Newfoundland and the spring and fall kill in Labrador, northern Quebec, and the eastern Arctic, much of it by indigenous peoples, is not sampled. Reed (in press) suggests that the total annual kill in eastern Canada is of the order of 100 000 full-grown birds, while thousands of eider eggs are also taken.

From a Canadian perspective the harvest of geese (Table 2) falls into two categories. There has been substantial growth in the Canadian kill of the most abundant species, the Canada and Snow geese, while the kills of White-fronted, Ross's, and Brant have not increased. In contrast, the larger American kill of Canada and Lesser Snow geese did not increase, and that of White-fronted Geese did.

The steadiness of the US national kill and the relatively slow growth of the Canadian kill of Canada Geese are the results of large regional fluctuations (including some local decreases). Thus the national totals may be rather poor guides to what could happen in the near future, apart from the impression that great increases in total population size or in the safe rate of exploitation of the species as a whole are unlikely.

The Lesser Snow Goose populations have exhibited large changes in regional distribution on passage and in winter, associated with the growth of southern breeding colonies, westward redistribution in the northeastern colonies, and declines in the northwest and, especially, on Wrangel Island (USSR) (Boyd *et al.* 1982; Kerbes 1982, 1983; Kerbes *et al.* 1983). These changes have resulted in rapid growth of the harvest in Manitoba and Saskatchewan and its decline around James Bay, especially on the Quebec side (discussed below). Internationally their effect has been to more than double the Canadian "market share", from 10.7% in1974 to 23.0% in 1982, approaching the 25% Canadian share of the total goose harvest.

The US did not resume the hunting of Greater Snow Geese along the Atlantic coast until 1975, after a closure of more than 40 years. The American hunt grew rapidly, but the ratio of kill in Canada to that in the USA seems to have settled at about 2:1. Reed *et al.* (1981) described the Greater Snow Goose kill in Canada and the USA in detail, incorporating the results of additional surveys. The reliability of the estimates from the US national surveys has been questioned in some Atlantic coast states, because local surveys

**Table 3**
Levels and trends in kill of species of ducks in Canada and USA, 1974–75 to 1982–83; mean annual change as % of mean annual kill in thousands. Only trends significant at 10% level are shown

| Species | Mean kill | Canada SE* | % change | Mean kill | USA SE | % change | Total % change | Canada % total |
|---|---|---|---|---|---|---|---|---|
| Wood Duck | 117 | 14 | — | 1189 | 140 | +2.9 | +3.4 | 8.9 |
| Mallard | 1583 | 220 | –4.7 | 4645 | 364 | –1.7 | –2.1 | 24.5 |
| Black Duck | 308 | 25 | — | 335 | 61 | –4.3 | — | 50.2 |
| Gadwall | 106 | 26 | –6.7 | 804 | 102 | — | — | 11.6 |
| Amer. Wigeon | 127 | 30 | –7.8 | 892 | 134 | — | — | 12.1 |
| Green-w. Teal | 206 | 30 | — | 1628 | 302 | — | — | 11.2 |
| Blue-w. Teal | 122 | 35 | –9.2 | 840 | 159 | — | — | 12.7 |
| Shoveler | 52 | 13 | –8.5 | 408 | 74 | –5.2 | –5.6 | 11.2 |
| Pintail | 163 | 44 | –10.1 | 1091 | 316 | –6.8 | –7.2 | 13.0 |
| Redhead | 47 | 13 | — | 143 | 31 | — | — | 24.5 |
| Canvasback | 29 | 9 | –7.2 | 78 | 24 | –7.4 | –2.4 | 27.0 |
| Greater Scaup | 58 | 12 | –6.1 | 80 | 31 | — | — | 42.0 |
| Lesser Scaup | 126 | 20 | –3.3 | 420 | 144 | — | — | 23.1 |
| Ring-necked Duck | 118 | 12 | — | 466 | 74 | –3.6 | — | 20.2 |
| Amer. Goldeneye | 110 | 10 | –2.0 | 85 | 11 | — | — | 56.5 |
| Bufflehead | 63 | 12 | –7.0 | 139 | 13 | — | –2.4 | 31.1 |
| Oldsquaw | 17 | 4 | — | 15 | 6 | — | — | 53.7 |
| Black Scoter | 23 | 9 | — | — | — | — | — | — |
| White-w. Scoter | 17 | 4 | — | 56 | 19 | –10.6 | –7.4 | 54.0 |
| Surf Scoter | 26 | 9 | — | — | — | — | — | — |
| C. Eider | 26 | 5 | — | 19 | 3 | — | — | 58.0 |
| C. Merganser | 27 | 4 | — | 31 | 7 | — | — | — |
| Red-br. Merganser | 14 | 4 | — | — | — | — | — | 57.3 |
| Hooded Merganser | 34 | 4 | — | 60 | 8 | — | — | 36.0 |
| Ruddy Duck | 4 | 2 | — | 60 | 15 | –5.4 | –5.5 | 6.9 |
| No. of species: | | | | | | | | |
| increasing | — | — | 0 | — | — | 1 | 1 | — |
| decreasing in kill | — | — | 11 | — | — | 8(+) | 7(+) | — |

*SE = standard error.

**Figure 6**
Estimates of waterfowl hunting effort in regions of Canada, 1974–75 to 1982–83, in thousands of hunter-days

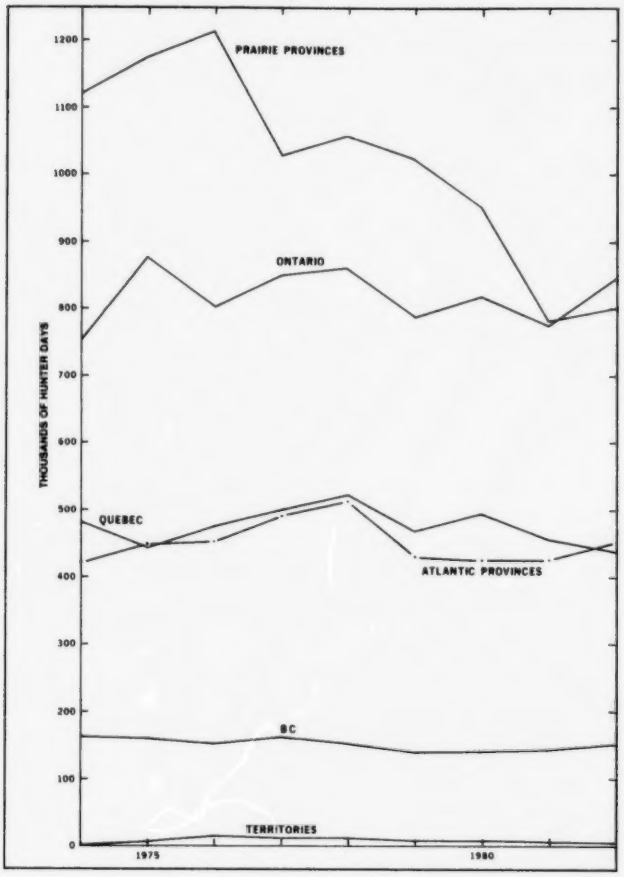
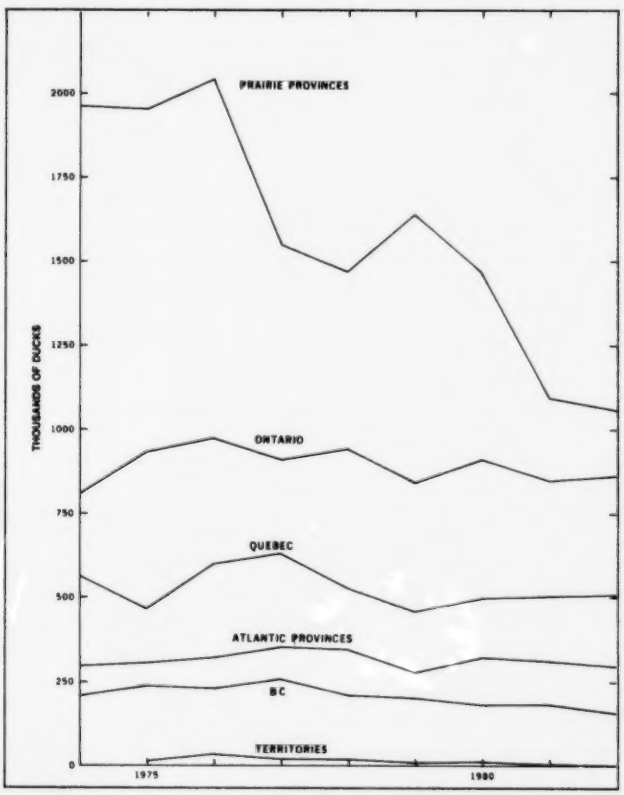



**Figure 7**
Estimates of regional kill of ducks in Canada, 1974–75 to 1982–83, in thousands




suggest that the kill is smaller than the national survey indicates. The combined kill has clearly risen, in line with the growth of the goose population itself, and may be approaching a level at which its impact is limiting population size.

Ross' Goose is much less scarce now than it was until a decade ago, with a breeding population of 77 300 geese in 1976 (Kerbes *et al.* 1983) and more than 90 000 in 1982 (Kerbes, in prep.). Thus the relaxation of special regulations (delayed opening) in Saskatchewan has not had dramatic effects on the Canadian kill, which has if anything declined. The reported kill in California has fluctuated more widely, with the combined kill varying less (7200–18 300, mean 12 500).

The Canadian kill of White-fronted Geese, averaging 60 000, has shown no trend, with the highest kill (79 000) in 1980 and the lowest (56 000) in 1982. In the USA the kill has grown from 87 000 in 1974 to 128 000 in 1982, with a jump to 199 000 in 1981. Thus the Canadian share has fallen from 37% to 28%, close to the average for all geese.

The hunting of Brant during the regular open season has dwindled in British Columbia, as it has on the US Pacific coast, in consequence of the bulk of Pacific Brant moving to winter in Mexico, rather than in California. The kill in the US Atlantic Flyway has been turned on and off by regulations, the reopening of a season in 1975 (after closure since 1972) having been followed by the disastrous effects of cold winter weather in 1976–77, with closure again until 1981. The relative importance of harvesting in Canada is impossible to establish from the standard NHS. In the east most of the kill occurs in the spring, by the Cree of northern Quebec and Ontario and by illegal hunters elsewhere in Quebec and the Maritimes. On the west coast a late opening permits the taking of Brant until 10 March, as they begin their northward movements. Who benefits, and to what extent, from this anomalous late season is uncertain, but very small numbers of hunters and geese are now involved.

### 3. Regional changes in hunting in Canada

During the years 1974–82 the amount of waterfowl hunting decreased by one-third in the Prairie Provinces, but showed no sustained change elsewhere (Fig. 6). The regional kill of ducks decreased by 47% in the Prairie Provinces, by 22% in British Columbia, and by 79% in the Northwest and Yukon territories (Fig. 7). The regional kill of geese increased by 50% in Ontario, 38% in the Prairie Provinces, and 85% in British Columbia, and decreased by 72% in the territories (Fig. 8).

The mean annual rates of change are summarized in Table 4. In the six eastern provinces the only persistent change was an increase in the kill of geese in Ontario and Quebec (apparent in Quebec only after adjustment for effort). It is the lack of change in the amount of waterfowl hunting and in the duck kill that is remarkable.

The decrease in waterfowl hunting in the Prairie Provinces and British Columbia has been accompanied by a

reduced kill of ducks and increasing kills of geese, with substantial changes in choice of quarry as more geese become available. About 80% of those prairie hunters who described themselves as active in a particular year reported success in killing ducks, compared with 44% successful in taking at least one goose. Over the period the proportion taking ducks decreased at an average rate of 1.32% per annum, while the proportion successfully hunting geese increased at 1.7%. With a fall of 18% in the number of active hunters from about 150 000 in 1979 and 1980 to about 123 800 in 1981 and 123 500 in 1982, successful duck hunters fell from 117 000 to 93 000 (–20.5%) and successful goose hunters from 72 600 to 63 000 (–13.1%). Figure 9 shows that the proportions of active hunters taking geese only and both ducks and geese rose, while those taking ducks only decreased more steeply. The proportion obtaining neither ducks nor geese also increased rather more rapidly and erratically than those taking geese.

The very large proportionate decreases in the reported kill of both ducks and geese in the Northwest Territories and the Yukon have had no national impact, because the numbers of buyers of MGBH Permits in the territories, where permits became obligatory only in 1974, have been so few. The numbers of active permit holders peaked in 1976 (2131 in the NWT and 409 in the Yukon) and fell to only 991 in 1982 (704 in the NWT, 287 in the Yukon). Native people being exempt from the requirement to hold a MGBH Permit, the activity of the majority of territorial waterfowl hunters is not sampled by the NHS. The fall in reported waterfowl hunting, particularly from 1980 to 1981 (30.5% fewer active hunters, 33.9% fewer successful ones), steeper than that in the prairies, seems likely to have been accentuated by the slowing down of northern economic development. But it was also accompanied by a drop in the number of ducks, and especially of geese, found in the Mackenzie Basin in the May aerial surveys.

## 4. Management issues

### 4.1. Declining hunting effort and changing success

Hunting in the Mississippi Flyway accounts for about 43% of the US total, with about 19% in each of the other three flyways and 0.6% in Alaska. Hunting has declined significantly in all four flyways, both when measured by hunter-days (at mean annual rates of 1.8–3.7%) and by numbers of successful hunters (annual rates of 1.6–3.1%), declining most in the Central Flyway and least in the Atlantic Flyway.

As the bulk of waterfowl from northern and western Canada winter in the Central and Mississippi flyways and those from the east winter in the Atlantic and Mississippi flyways, there are obvious parallels between regional declines in the two countries. Table 5 lists significant trends in the flyways and regions. Although Canadian waterfowl hunting has decreased less than American, the return for effort in

**Figure 8**
Estimates of regional kill of geese in Canada, 1974–75 to 1982–83: (upper) kill in thousands, (lower) kill per 1000 hunter-days

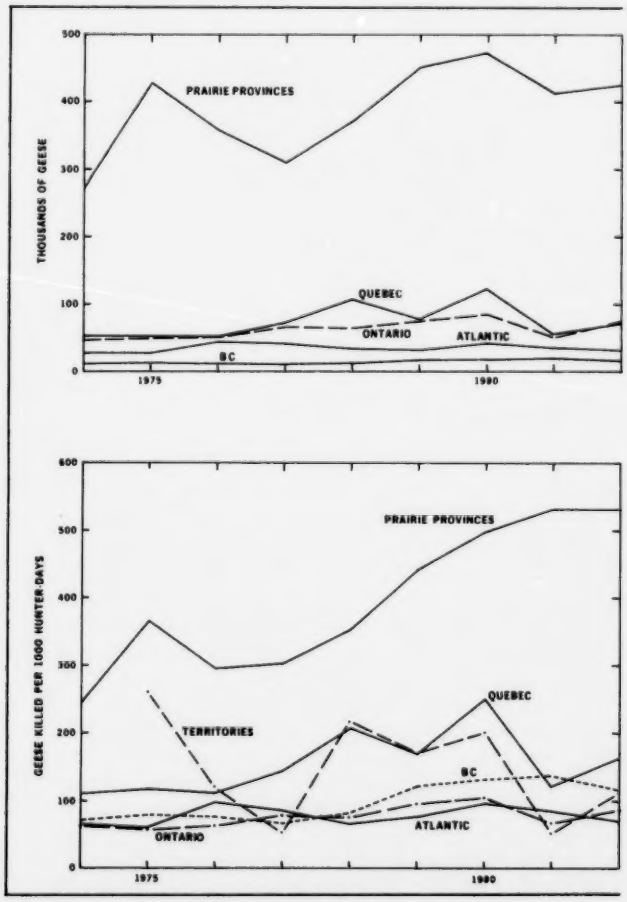



**Figure 9**
Percentages of active hunters in Prairie Provinces taking ducks only, geese only, both ducks and geese, or neither (i.e. unsuccessful throughout season), 1974–75 to 1982–83

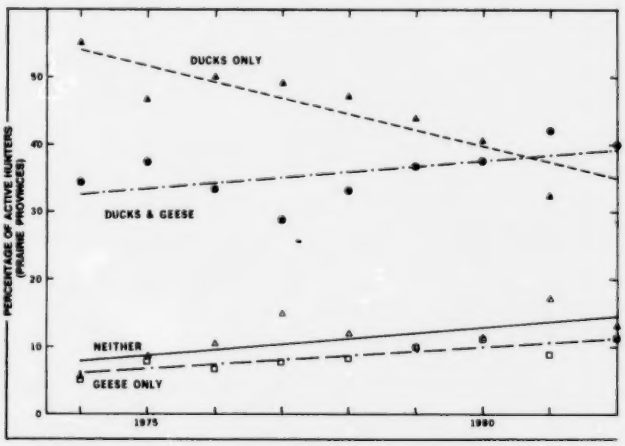



**Table 4**
Mean annual rates of change (as % of period mean) in waterfowl hunting activity and kill in major regions of Canada, 1974–75 to 1982–83

| Region | Activity (hunter-days) | Duck kill | | Goose kill | |
|---|---|---|---|---|---|
| | | No. | Per 1000 hunter-days | No. | Per 1000 hunter-days |
| Atlantic | 0 | 0 | 0 | 0 | 0 |
| Quebec | 0 | 0 | 0 | 0 | 5.7 |
| Ontario | 0 | 0 | 0 | 5.0 | 4.9 |
| Prairie Provinces | –4.9 | –7.6 | –2.9 | 4.0 | 9.3 |
| British Columbia | –1.5 | –3.1 | –1.9 | 7.5 | 8.9 |
| Territories | 0 | –17.7 | –9.3 | –13.9 | –14.7 |

**Table 5**
Mean annual rates of change, as % of period mean, in waterfowl hunting activity and kill in Canadian regions and in US flyways, 1974–75 to 1982–83, and mean kills in 1982–83. Only trends significant at 10% level are shown

| Canadian Region | US flyway | Hunter-days | | Successful hunters | | Ducks/hunter | | Geese/hunter | | Kill/hunter in 1982–83 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Ducks | | Geese | |
| | | Canada | USA | Canada | USA | Canada | USA | Canada | USA | Canada | USA | Canada | USA |
| BC | | –1.5 | | — | | –2.8 | | 8.8 | | 9.3 | | 1.0 | |
| | Pacific | | –3.0 | | –3.1 | | — | | — | | 8.5 | | 0.8 |
| Prairies | | –4.9 | | –3.0 | | –5.5 | | 6.6 | | 8.6 | | 3.5 | |
| | Central | | –3.7 | | –3.1 | | — | | 4.8 | | 5.9 | | 1.2 |
| | Mississippi | | –1.7 | | –3.0 | | 2.1 | | 4.0 | | 7.0 | | 0.6 |
| Ontario | | — | | — | | — | | 4.8 | | 7.8 | | 0.7 | |
| Quebec | | — | | 1.1 | | –3.0 | | — | | 8.8 | | 1.3 | |
| Atlantic | | –1.1 | | — | | — | | — | | 6.9 | | 0.8 | |
| | Atlantic | | –1.6 | | — | | — | | — | | 4.4 | | 1.0 |
| Canada | | –0.9 | | –1.5 | | –3.3 | | 5.2 | | 8.1 | | 1.8 | |
| | USA | | –2.2 | | –2.7 | | — | | 3.2 | | 6.6 | | 0.8 |

Canada has changed more, with larger decreases in ducks per hunter in the Prairie Provinces and Quebec than in any part of the USA: hunters in the Mississippi Flyway have increased their *per capita* success. Despite the deterioration in the Canadian take of ducks it is noteworthy that in 1982, the worst year in the series, the average duck kills per hunter in all the major regions of Canada were greater than those in the US flyways sharing the same birds, with the competitive advantage greatest in the east, rather than in the west as it was until very recently.

In the Atlantic Region the mean kill of geese was nearly steady and less than in the US Atlantic Flyway. The greater rate of increase in the kill of geese per hunter in Ontario and western Canada resulted in a higher kill in 1982 in those regions than in the adjacent flyways. The most important point about the increased goose kill in western Canada and the Central and Mississippi flyways is that it did not result from increased goose populations so much as from increased availability of geese to hunters, as a result of changing patterns of distribution in the fall. Longer stays of staging geese in the southern prairies and the north-central states have exposed them to far more hunting.

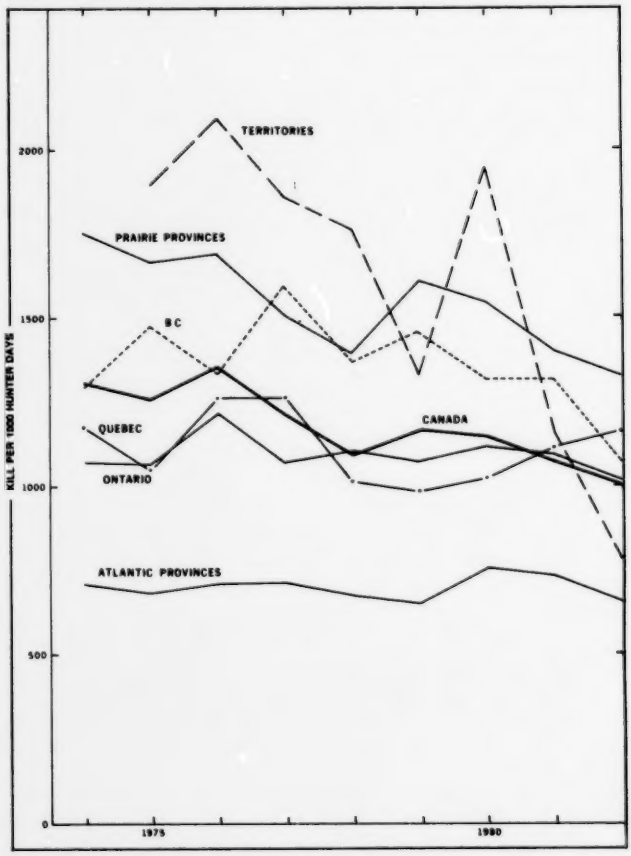
Another important point about the growing western Canadian goose kill is that, like the kill in the USA, it is largely of birds grown in the Northwest Territories, not of locally produced birds. Thus, to the extent that prairie hunters are taking geese rather than ducks, they increasingly resemble US hunters in depending on external sources of supply.

### 4.2. Fewer ducks per hunter

The relationships between kill and duck numbers are complex, being affected by the distribution as well as the abundance of both hunters and ducks. In Canada as a whole, and in each region, the kill per 1000 hunter-days tended to fall between 1974 and 1982, though the decline was not statistically significant in the Atlantic, Quebec, and Ontario regions. In three of the US flyways and in Alaska, the per-hunter kill of ducks tended to increase over time, though not significantly so. The exception was the Pacific flyway, though the decrease there was not enough to be statistically significant.

This contrast between declining return for effort in Canada and sustained or increasing yield in the USA could have been achieved in a variety of ways, the relative importance of which cannot be determined from the harvest survey data alone. From the declining numbers of ducks detected in western and northwestern Canada in the May and July aerial surveys, the unexpected result is the sustained kill in the western USA, not the drop in Canada. This seems to suggest that the efficiency of harvesting in the USA has increased, as was also shown by the growth in the average seasonal bag in the USA (Fig. 3).

**Figure 10**
Regional kill of ducks in Canada, 1974–75 to 1982–83, per 1000 hunter-days




The decline in duck hunting success in western and northwestern Canada during 1974–82, and particularly from 1977 onwards (summarized in Table 4 and Figure 10) implies that western Canada, formerly the principal continental supplier, is no longer producing far more than enough ducks for its own hunters: see Boyd and Cooch (1983) and Cooch and Boyd (1984) for detailed discussion of this transformation.

4.3. How long can the goose-harvest boom last?

One immediate answer is given by looking at the harvest in the latest 5 years (1978–82) rather than the run of 9 years used elsewhere. Since 1978 the only Canadian region showing a clear increase in goose kill is British Columbia, which contributed only 2.8% of the kill reported during that time. Thus the upsurge seems to be over, and for some species in some regions declines are underway. The most notable case is that of Canada Geese in Quebec, where the kill peaked at 65 000 in 1978 but had fallen to 29 000 in 1982. Declines in the kill of Lesser Snow Geese in Ontario and Alberta (though not Manitoba and Saskatchewan) are also clearly marked.

In most places the size of the goose kill tends to be higher in years when many young have been reared than in years of poor production, so that the harvest is sensitive to spring and summer weather in the Arctic. The increased frequency of poor summers apparent in the Foxe Basin area (of special importance for Lesser Snow Geese and Atlantic Brant), when we compare 1970–82 with 1950–65 (Boyd *et al.* 1982), may have caused the Snow Goose harvest to fall.

Supplies of arctic-nesting geese cannot be taken for granted to the extent that is possible for southern-reared Canada Geese, including those spread deliberately in parts of southern Canada and the northern USA. Geese produced from restocking programmes may prove more helpful in Canada in future years than they have seemed to be hitherto, while being outshone by much larger numbers of northern geese. The major points here are that: (1) continuous monitoring is very important, because of the volatility of the supply; and (2) "free goods" from the north are unlikely to increase and could well dwindle in the next decade and beyond.

4.4. Harvest by native people

Many sport hunters, especially in the USA, seem to believe that the rapidly expanding, though still relatively small, Indian and Inuit populations of Canada are taking vast numbers of geese and ducks. Though knowledge of their kill is less complete than could be wished, the likelihood seems to be that the Canadian native kill amounts to less than 5% of the total kill of ducks in the USA and Canada, and about 7% of the continental goose kill (Table 6). Around James Bay, which serves as a major staging area in both spring and fall, and where in consequence waterfowl play a far larger part in Indian hunting than elsewhere, the Cree kill fell substantially at the end of the 1970s (JBNQ Native Harvesting Research Committee 1982). That was probably due chiefly to reductions in the numbers of waterfowl stopping there (whether as a consequence of the ecological changes following the construction of Phase I of the massive hydro-electric development is not clear).

Hunting by northern native people will undoubtedly continue to cause concern, because their populations are growing faster than those in most other parts of North America, and because most northern hunters now have access to modern equipment (aircraft, all-terrain vehicles, boats with powerful motors, as well as firearms) so that their potential abilities to take large numbers of birds have been increased. Raveling (1984) has reported on a serious decline in the numbers of geese breeding in the Yukon–Kuskokwim delta, Alaska, associated with intensified spring hunting by local people. Cooch (in press) has documented a relatively minor case in Canada, the destruction of the Northern Eider population of the west Foxe Islands, on the southwest coast of Baffin Island, by indiscriminate egg-taking and shooting of adult females. "Burning out" of local stocks of geese and ducks seems to have occurred in the vicinity of some other northern settlements, as has, of course, often happened in the more densely peopled south. Nevertheless, there are so few hunters, so thinly spread, in the north that on the continental scale their impact seems likely to remain small.

4.5. Are the NHS data adequate?

Although people interested in the kill of a single species, or with local rather than wide concerns, would like to have far more intensive sampling, the existing levels of sampling and of response in Canada to both the NHS and SCS seem adequate for the needs of international monitoring (Cooch *et al.* 1978, Boyd 1983).

The greatest, and growing, threats to continued satisfactory performance are administrative ones. The surveys are subject to acceptance and prompt handling by Canada Post, on which CWS is dependent for distributing MGBH Permits, NHS questionnaires, and SCS wing envelopes. This is an uncomfortable state of affairs, especially with respect to the SCS. At the insistence of the Post Office unions, changes have repeatedly been made in the containers for duck wings and goose tails, in efforts to reduce the frequency of obnoxious packages accumulating in mail rooms. Unfortunately, the changes they have called for have tended to aggravate rather than reduce the nuisance, by encouraging decomposition in more nearly airtight envelopes. There is a continuing threat of refusal to handle the wings.

Chronic problems have also occurred in the distribution of MGBH permits in ample time before the opening of the hunting season, in unwillingness to advertise Migratory Birds Convention Act Regulations and permits, and in ensuring the prompt return of permit sales records. None of these difficulties is likely to be alleviated, and some would undoubtedly be aggravated, by attempts to use vendors other than post offices. The success of the Alberta Treasury Branch in selling MGBH Permits in its regional offices created a precedent for using provincial outlets but that organization has now abandoned the distribution of provincial hunting licences, as well as of MGBH Permits. No other provinces have departmental machinery capable of providing prompt returns of sales records during the season, so as to allow sampling to continue to be based on same-season permit buyers, an important reason for the precision of the NHS.

4.5.1. Results from the Statistics Canada wildlife survey, 1982

In 1981, 465 000 MGBH Permits were sold in Canada (less than 1300 in the territories). The NHS indicated that 76% of the permit purchasers (343 000) actively hunted waterfowl that year, with 64% (297 000) claiming to have been successful in shooting at least one duck or goose (Métras

**Table 6**
Estimates of mean annual kill of waterfowl by Canadian Indians and Inuit compared with kill by other Canadians, 1974–77 and 1978–82, and with American sport kill, in thousands.

| | Ducks | | Geese | |
|---|---|---|---|---|
| Category | 1974–77 | 1978–82 | 1974–77 | 1978–82 |
| Kill reported by MGBH Permit holders | 3 929 | 3 247 | 503 | 640 |
| Unreported sport kill | 786 | 649 | 75 | 96 |
| James Bay kill (Que. + Ont.) | 70 | 45 | 165 | 130 |
| Other native kill | 940 | (940) | 40 | 50 |
| Total Canadian kill | 5 725 | 49 881 | 283 | 916 |
| Total US sport kill | 17 135 | 15 995 | 1964 | 1968 |
| Total kill | 22 860 | 20 876 | 2747 | 2884 |
| % of total by native peoples in Canada | 4.4 | 4.8 | 7.5 | 6.2 |

**Table 7**
Number of waterfowl hunters in provinces of Canada active in 1981, estimated from: (1) NHS of buyers of MGBH Permits (Métras 1983); and (2) Statistics Canada Labour Force Survey on wildlife interests, 1982 (Filion *et al.* 1983) and impacts, in thousands to 0.1. Last row compares US Duck Stamp sales with waterfowl hunting activity reported in 1980 survey of wildlife-associated recreation (USFWS 1982)

| | NHS — no. buyers of MGBH Permits claiming to hunt waterfowl | | | Stats. Can. survey: persons claiming to hunt waterfowl | | | |
|---|---|---|---|---|---|---|---|
| | | 95% confidence limits | | | 95% confidence limits | | $PH_c/$ |
| Province | PH* | Lower | Upper | WH† | Lower | Upper | WH |
| Nfld. | 20.2 | 18.8 | 21.6 | 38.0 | 33.4 | 42.6 | 53.1 |
| PEI | 4.8 | 4.5 | 5.1 | 6.2 | 4.3 | 8.1 | 77.9 |
| NS | 9.9 | 9.1 | 10.7 | 22.9 | 19.2 | 26.5 | 43.3 |
| NB | 8.7 | 8.0 | 9.3 | 16.8 | 13.6 | 19.9 | 51.8 |
| Que. | 55.2 | 52.3 | 58.1 | 133.4 | 124.5 | 142.4 | 41.4 |
| Ont. | 106.3 | 100.8 | 111.8 | 215.8 | 204.2 | 227.5 | 49.3 |
| Man. | 38.9 | 36.9 | 40.9 | 44.0 | 39.0 | 49.1 | 88.3 |
| Sask. | 35.2 | 33.0 | 37.4 | 52.2 | 46.8 | 57.7 | 67.4 |
| Alta. | 49.9 | 47.3 | 52.6 | 89.2 | 82.1 | 96.3 | 56.0 |
| BC | 18.1 | 16.7 | 19.5 | 39.6 | 34.8 | 44.4 | 45.7 |
| All provinces | 347.2 | 327.5 | 367.0 | 658.2 | 639.1 | 677.3 | 52.8 |
| USA, 1980 | 1614.6 | | | 5310.8 | | | 30.4 |

*PH = Active permit holders.
†WH = Claimed waterfowl hunters.

1983). From the reports of NHS respondents it appeared that they hunted on 2.75 million days.

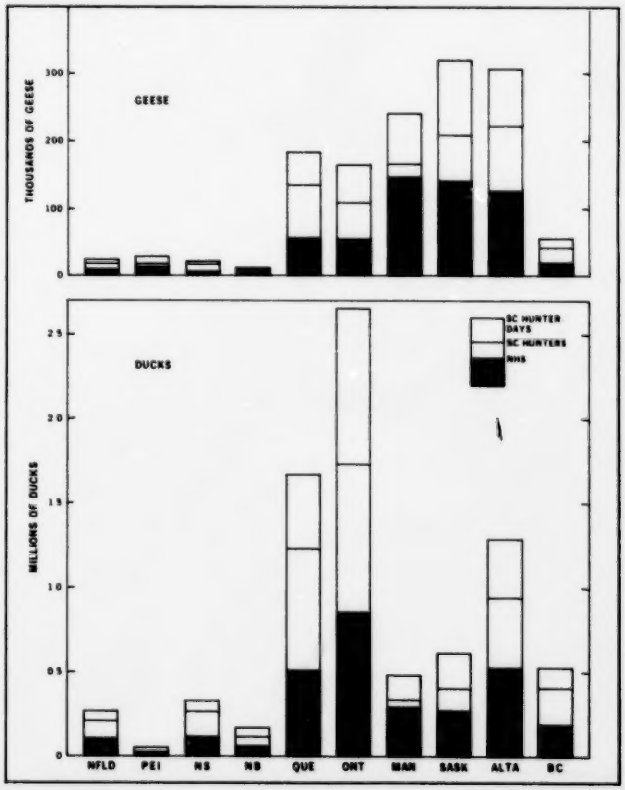
A quite independent source of information about the amount of waterfowl hunting in 1981 has recently been provided by the national survey of *The Importance of Wildlife to Canadians*, undertaken by Statistics Canada in 1982: "Using the Labour Force Survey, which employed a national multi-stage probability sample design as a vehicle, a mail-back survey was delivered to 99 601 individuals; 76 201 surveys were returned giving a 76.5% response. The Labour Force Survey covered approximately 98% of the Canadian population 15 years of age and over. Populations in the Yukon and Northwest Territories, residents of Indian Reserves, full-time members of the Canadian Armed Forces and inmates of institutions were excluded." (Filion *et al.* 1983).

Waterfowl hunting formed only a small part of the field being investigated by means of the survey, using 10 questions of 67 asked, with seven of these relating to expenditures. Some of the responses were incomplete, but the high response rate to the survey as a whole encourages the belief that the sampling was effective in identifying the extent of involvement of Canadians in wildlife-related activities. Responses were analysed by the age, sex, and educational level of participants, and by place of residence. Here we are concerned solely with the amount of waterfowl hunting (numbers of people hunting in 1981 and on how many days they hunted) and how many were successful. The survey asked whether any waterfowl were bagged, but not how many and of what species.

In Table 7 the numbers of people who hunted waterfowl in each province in 1981, estimated from responses to the Labour Force Survey questionnaire, are compared with the estimates from the NHS Survey, limited to purchasers of MGBH Permits. The results suggest that nearly half the people who hunted waterfowl in 1981 did so without buying a MGBH Permit, the proportion of permit-buyers being lowest in Quebec (41%), Nova Scotia (43%), and British Columbia (46%), and highest in Manitoba (85%), Prince Edward Island (78%), and Saskatchewan (67%). The 95% confidence limits for the two sets of estimates overlap only for Prince Edward Island and Manitoba.

Table 8 and Figure 11, dealing with the amount of waterfowl hunting reported, show even greater disparity between the estimates from the two surveys. The Statistics Canada survey suggests that there were nearly three times as many days spent in waterfowl hunting as those identified by means of the NHS. The differences between the estimates are due much more to the greater number of people involved than to the average number of days during the year on which active respondents hunted, though in all provinces the latter

**Figure 11**
Alternative estimates of the kill of ducks and geese in the provinces of Canada in 1981, from NHS and from Statistics Canada estimates of hunter numbers and activity



was greater according to the Statistics Canada survey than according to the NHS. That seems to imply that non-buyers of the MGBH Permit spent more time waterfowl hunting than did those hunting legally with the permits.

Before considering what effect this apparent disclosure of much waterfowl hunting activity by non-buyers of MGBH Permits has on estimates of the kill of ducks and geese, one should look at the responses to Statistics Canada wildlife survey question 40: "Did you bag any waterfowl?"

**Table 8**
Estimates of total number of days on which people hunted waterfowl in provinces of Canada in 1981, and of average number of days on which each respondent hunted, from (1) NHS and (2) Statistics Canada Labour Force Survey, 1982. Last row compares results of USA surveys in 1980 (see text)

| | Waterfowl hunter-days (thousands) | | | Mean no. days per active hunter | | |
|---|---|---|---|---|---|---|
| Province | NHS | Stats. Can. | NHS/Stats. Can. % | NHS | Stats. Can. | NHS/Stats. Can. % |
| Nfld. | 248.6 | 588.0 | 42.3 | 12.3 | 15.5 | 79.6 |
| PEI | 48.5 | 94.1 | 51.5 | 10.1 | 15.3 | 66.1 |
| NS | 101.1 | 287.9 | 35.1 | 10.2 | 12.6 | 81.2 |
| NB | 56.6 | 160.0 | 35.4 | 6.5 | 9.5 | 68.2 |
| Que. | 505.5 | 1 658.9 | 30.5 | 9.2 | 12.4 | 73.7 |
| Ont. | 823.7 | 2 569.9 | 32.1 | 7.8 | 11.6 | 66.8 |
| Man. | 257.4 | 419.6 | 61.4 | 6.6 | 9.5 | 69.5 |
| Sask. | 211.8 | 477.9 | 44.3 | 6.0 | 9.2 | 65.8 |
| Alta. | 349.9 | 855.3 | 40.9 | 7.0 | 9.6 | 73.1 |
| BC | 154.2 | 434.0 | 35.5 | 8.5 | 11.0 | 77.7 |
| All provinces | 2 757.2 | 7 545.6 | 36.5 | 7.9 | 11.5 | 69.3 |
| USA | 14 304.4 | 42 909.6 | 33.3 | 7.0 | 8.0 | 87.5 |

**Table 9**
Percentage of active hunters who claimed success in bagging one or more ducks or geese in 1981, from (1) NHS and (2) Statistics Canada Wildlife Survey: (a) yes/(yes + no); (b) yes/total

| | | Statistics Canada | |
|---|---|---|---|
| Province | NHS | (a) | (b) |
| Nfld. | 70.3 | 59.7 | 54.3 |
| PEI | 84.0 | 98.4 | 65.3 |
| NS | 80.6 | 97.9 | 57.4 |
| NB | 79.2 | 96.1 | 59.7 |
| Que. | 84.2 | 59.4 | 53.1 |
| Ont. | 79.0 | 60.6 | 54.0 |
| Man. | 86.7 | 73.5 | 71.0 |
| Sask. | 86.4 | 85.2 | 71.6 |
| Alta. | 86.1 | 100.0 | 65.9 |
| BC | 82.2 | 100.0 | 63.9 |
| All provinces | 82.3 | 71.2 | 58.9 |

There is some ambiguity in the responses, because in half the provinces many hunters did not answer this question (41% in Nova Scotia, 38% in New Brunswick, 36% in British Columbia, 34% in Alberta, and 33% in Prince Edward Island), and in Alberta and British Columbia no "No" answers were recorded, which seems unlikely to reflect the true situation. In Table 9 columns (a) and (b) reflect these vagaries. Nationally, the proportion of successful hunters recorded by the Statistics Canada survey was less than that estimated from responses to the NHS.

If it is assumed that the average seasonal bags reported by NHS respondents (MGBH Permit-holders) are also representative of the success of non-permit-holders, two sets of estimates of provincial waterfowl kill can be obtained from the Statistics Canada wildlife survey, using NHS estimates of the average bag per active hunter and per successful hunter respectively. Table 10 compares those estimates of the kill with those from the NHS. (It is not possible to separate the kill of ducks from that of geese in the available records.) There are major differences between the three sets of estimates. The NHS estimates are by far the lowest, because they reflect the much smaller numbers of active waterfowl hunters identified by means of the NHS sampling scheme. In Manitoba, where the NHS and Statistics Canada estimates of hunter numbers are closest, the three kill estimates are also quite close. There are massive differences between the alternative estimates in Quebec and Ontario.

An alternative way of looking at the differences between these estimates of kill is to treat the excess of the Statistics Canada estimates over those from the NHS as estimates of illegal kill, with virtually none in Manitoba and Prince Edward Island, though 26% nationally, and about 40% in British Columbia and Nova Scotia.

These extrapolations, using NHS measures of success, must be treated merely as speculations. Until further work has been done using the Labour Force Survey framework, and preferably some other independent approaches, to estimate the scale of unmeasured (mostly illegal) hunting, I think it would be unwise to depart from the relatively precise NHS results in tracking changes in waterfowl kill in Canada.

The large discrepancies between the estimates of waterfowl hunting activity obtained from the Labour Force Survey and the NHS have been paralleled and exceeded in the USA, where the USFWS has contracted out studies of public interest in, and activities related to, wildlife at 5-yearly intervals, as well as conducting annual waterfowl harvest surveys. The latest general survey related to 1980 (USFWS

**Table 10**
Estimates of provincial waterfowl kill in 1981 derived from numbers of hunters identified in Statistics Canada wildlife survey: (1) Active = (no. of active hunters) × (mean seasonal bag per active hunter); (2) Successful = (no. of successful hunters) × (mean seasonal bag per successful hunter). Mean seasonal bag estimates from NHS. In thousands, ducks and geese together

| | Retrieved waterfowl kill | | | NHS estimate as % of | | "Illegal kill" | |
|---|---|---|---|---|---|---|---|
| Province | Active | Successful | NHS | Active | Successful | Succ.-NHS | % of Success |
| Nfld. | 236 | 181 | 124 | 52.5 | 68.5 | 57 | 31.5 |
| PEI | 52 | 41 | 41 | 78.8 | 100.8 | 0 | 0 |
| NS | 279 | 200 | 121 | 43.4 | 60.5 | 79 | 39.5 |
| NB | 122 | 92 | 63 | 51.6 | 68.5 | 29 | 31.5 |
| Que. | 1361 | 859 | 564 | 41.4 | 65.7 | 295 | 34.3 |
| Ont. | 1834 | 1252 | 903 | 49.2 | 72.1 | 349 | 27.9 |
| Man. | 498 | 409 | 441 | 88.6 | 107.8 | −32 | 0 |
| Sask. | 616 | 510 | 415 | 67.4 | 81.4 | 95 | 18.6 |
| Alta. | 1160 | 890 | 651 | 56.1 | 73.1 | 239 | 26.9 |
| BC | 455 | 347 | 208 | 45.7 | 59.9 | 139 | 40.1 |
| All provinces | 6713 | 4792 | 3531 | 52.6 | 73.7 | 1261 | 26.3 |

1982). The last row in Table 7 compares the estimated numbers of US Duck Stamp buyers who claimed to have hunted waterfowl in 1980 with the number of waterfowl hunters that year estimated from the Wildlife Activity Survey, indicating that only 30% of the claimed hunters were holders of Duck Stamps. The last row of Table 8 shows a similar disparity between the estimates of hunter-days: 14.3 million from the NHS, compared with 42.9 from the Wildlife Activity Survey (33.3%). The difference between the estimates of mean numbers of days hunted per active hunter is much less: 7.0 versus 8.0.

These phenomena require further study. The important consideration here is that there is no reason to suppose that the two national harvest surveys differ so much in the extent to and consistency with which they detect waterfowl hunters and their activity that they cannot be used for comparing changes over time in waterfowl hunting and kill in Canada and the USA.

### 4.5.2. Saskatchewan Hunter and Game Population Survey and the NHS

In Saskatchewan, hunters of waterfowl are required to hold a provincial Game Bird Licence as well as the federal MGBH Permit. The province conducts annual mail questionnaire surveys of the hunting activity and success of game-bird hunters, sending questionnaires to a sample of about one-third of the licence purchasers in the previous year, with rather low response rates (17% in 1979, 26% in 1980), so that, though the sampling intensity is up to seven times greater than in the NHS, the usable responses are 2–5 times as numerous. The efficiency and reliability of the provincial survey with respect to waterfowl hunting, only a small part of the inquiry, has not been studied as intensively as the performance of the NHS, but it seems likely that the two surveys are of the same order of precision (about ±5% for the number of active hunters, and ±16% for duck kill and goose kill).

In 1978–82 the Saskatchewan Hunter and Game Population Survey (SHS) identified about 7% more active waterfowl hunters in the province than estimated from the NHS, about 11% more successful duck hunters, and nearly 16% more successful goose hunters (Table 11). Over the eight seasons of 1975–82, the SHS estimates of duck kill averaged 476 000, compared with 535 000 from the NHS (Table 12), i.e. 11% less. The provincial estimate of geese killed averaged 11% higher (164 000) than the NHS (148 000). Thanks to pronounced decreases in the numbers of active and successful duck hunters, the correlations of year-to-year variations seem very high. After partitioning out the downward trends shown by both surveys, the correlations are low.

Comparisons of the SHS and NHS estimates of the kills of Mallard and other ducks, and Canada, White-fronted, Snow, and other geese show encouragingly close resemblances in general (Table 12), with occasional departures as a reminder of the fallibility of mail sample surveys.

The SHS estimates of active waterfowl hunters in the province in 1981 were 38 261, compared with 35 196 from the NHS and 52 242 from the Statistics Canada Wildlife Survey, suggesting either that the SHS as well as the NHS failed to detect an appreciable number of people hunting without being in possession of a provincial licence or a MGBH Permit, or that some of the hunting activity claimed by respondents to the Statistics Canada wildlife survey was imaginary.

**Table 11**
Estimates from Saskatchewan Hunter and Game Population Survey (SHS) and from NHS of numbers of active and successful waterfowl hunters in Saskatchewan, 1978–82, in thousands to 0.1

| | Active hunters | | Successful hunters of ducks | | Successful hunters of geese | |
|---|---|---|---|---|---|---|
| Year | SHS | NHS | SHS | NHS | SHS | NHS |
| 1978 | 45.0 | 51.5 | 41.9 | 42.1 | 26.5 | 22.8 |
| 1979 | 51.3 | 48.5 | 41.7 | 39.4 | 28.8 | 24.0 |
| 1980 | 48.6 | 45.4 | 35.8 | 35.8 | 28.4 | 25.3 |
| 1981 | 38.3 | 35.2 | 33.6 | 24.9 | 23.2 | 20.0 |
| 1982 | 42.4 | 37.7 | 29.1 | 28.0 | 25.5 | 22.5 |
| Mean | 45.1 | 43.7 | 36.4 | 34.0 | 26.5 | 22.9 |
| Trend $r_t$ | –0.56 | –0.93 | –0.97 | –0.92 | –0.53 | –0.37 |
| slope | –1.8 | –4.1 | –3.4 | –4.3 | — | — |

**Table 12**
Estimates of kill of ducks and geese in Saskatchewan in 1975–82, derived from Saskatchewan Hunter and Game Population Survey (SHS) and NHS, in thousands

| | | | | | | | | | | Trend | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Kill of | | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | Mean | $r_t$ | slope |
| Mallard | SHS | 533 | 582 | 366 | 318 | 432 | 322 | 196 | 222 | 371 | –0.87 | –49.1 |
| | NHS | 572 | 609 | 392 | 397 | 423 | 355 | 230 | 243 | 403 | –0.92 | –51.0 |
| Other ducks | SHS | 178 | 165 | 92 | 87 | 122 | 76 | 44 | 69 | 104 | –0.85 | –16.4 |
| | NHS | 235 | 199 | 117 | 130 | 165 | 89 | 43 | 83 | 133 | –0.86 | –22.5 |
| Total ducks | SHS | 711 | 747 | 458 | 405 | 554 | 398 | 240 | 292 | 476 | –0.87 | –65.6 |
| | NHS | 807 | 808 | 509 | 527 | 583 | 444 | 273 | 326 | 535 | –0.91 | –73.5 |
| Canada Geese | SHS | 103 | 96 | 87 | 70 | 86 | 108 | 92 | 83 | 91 | (–0.20) | — |
| | NHS | 95 | 72 | 66 | 73 | 84 | 94 | 87 | 87 | 82 | (0.31) | — |
| White-fronted Geese | SHS | 40 | 44 | 46 | 48 | 50 | 43 | 43 | 42 | 44 | (0.02) | — |
| | NHS | 46 | 52 | 42 | 50 | 49 | 57 | 37 | 39 | 46 | (0.24) | — |
| Snow Geese* | SHS | 17 | 25 | 26 | 25 | 22 | 26 | 21 | 26 | 24 | (0.36) | — |
| | NHS | 17 | 24 | 14 | 28 | 30 | 19 | 18 | 26 | 21 | (0.24) | — |
| Total geese | SHS | 165 | 171 | 165 | 147 | 164 | 185 | 159 | 155 | 164 | (–0.14) | — |
| | NHS | 157 | 148 | 122 | 139 | 152 | 170 | 141 | 152 | 148 | (0.18) | — |

*Includes Ross' Geese, not separated in the SHS.

# Concluding comments

"Waterfowl populations must be monitored to ensure firstly that hunting does not drive them to dangerously low levels, and secondly that hunting does not, of itself, destroy or injure the basis of the sport that it constitutes.

"No country presently boasts a workable system, rising above the level of trial and error, for estimating optimal offtake of waterfowl. No country provides a model of waterfowl population dynamics, its efficacy tested against the realities of that country's environmental conditions, waterfowl populations and hunting pressure. Hence there is no pre-adapted system from overseas that might serve as a template for shaping a system appropriate to Australian conditions." (Caughley and Briggs 1983).

This critical assessment of the accomplishments of North American (and European) waterfowl management is unfortunately correct. It serves as a reminder of how primitive the state of the craft still is, despite more than 50 years of work by many people, especially in the USA and Canada.

Perhaps the most disconcerting finding in this report is the evidence, provided by the *Importance of Wildlife to Canadians* (Filion *et al.* 1983) that a large amount of recreational waterfowl hunting in Canada may be escaping the fact-finding net of the NHS, in addition to the acknowledged lack of widespread and continuous monitoring of subsistence and recreational hunting by the indigenous peoples of Canada, Alaska, and the remainder of the USA. If the scale of impact of undetected hunting is staying nearly constant in relation to the sampled hunting, the existing national surveys may be adequate for monitoring, but no one knows whether that is the case. Thus it is surely more important to tackle the problems of unmeasured hunting than to put much more effort into refining the precision of the two national harvest surveys.

The importance of the adequacy of harvest surveys is not only that harvest statistics are easier and less expensive to obtain than most direct measurements of waterfowl population parameters on the continent-wide scale, but that, as Caughley and Briggs (*loc. cit.*) note ". . . only catch-per-unit-effort theory stands a reasonable chance of working in practice . . ." as a means for estimating optimal offtake of waterfowl. The present time, when prairie duck populations are much depleted and producing exceptionally poorly, offers as good an opportunity as we may get of studying the impact of intensive hunting on duck stocks. If existing information proves to be wholly insufficient for distinguishing between the working of alternative models of exploitation, North American waterfowl managers may be judged as having failed in the simple, if often highly frustrating, tasks of securing and deploying resources adequate for framing and answering the necessary questions.

There is no need for pessimism on this account, despite the continuance of "government restraint programs". There is need for persisting in strenuous efforts to develop and maintain a sufficient (but not an extravagant) monitoring system and management systems based on the information obtained and for securing their acceptance and use throughout North America. If efforts to improve North American waterfowl management during the rest of the 20th century should fail, our legacy of waterfowl will be a meagre one, comparable to that of Europe. The most likely causes of failure are political indifference, professional stupidity, and inability to compete successfully with other claimants on the wetland resources of the continent. None of the difficulties is insurmountable.

# Appendix

**Appendix 1**
List of scientific names of geese and ducks referred to by vernacular names in the text

| | |
|---|---|
| ***Tribe Anserini*** | |
| White-fronted Goose | *Anser albifrons* (Scop.) |
| Snow Goose | *Anser caerulescens* (L.) |
| Lesser Snow Goose | *A.c. caerulescens* |
| Greater Snow Goose | *A.c. atlantica* (Kennard) |
| Ross' Goose | *Anser rossii* (Cassin) |
| Brant | *Branta bernicla* (L.) |
| Canada Goose | *Branta canadensis* (L.) |
| ***Tribe Cairinini*** | |
| Wood Duck | *Aix sponsa* (L.) |
| ***Tribe Anatini*** | |
| Mallard | *Anas platyrhynchos* L. |
| Black Duck | *Anas rubripes* (Brewster) |
| Gadwall | *Anas strepera* (L.) |
| American Wigeon | *Anas americana* (Gmelin) |
| Green-winged Teal | *Anas crecca* (L.) |
| Blue-winged Teal | *Anas discors* (L.) |
| Shoveler | *Anas clypeata* (L.) |
| Pintail | *Anas acuta* (L.) |
| ***Tribe Aythyini*** | |
| Redhead | *Aythya americana* (Eyton) |
| Canvasback | *Aythya valisineria* (Wilson) |
| Greater Scaup | *Aythya marila* (L.) |
| Lesser Scaup | *Aythya affinis* (Eyton) |
| Ring-necked Duck | *Aythya collaris* (Donovan) |
| ***Tribe Mergini*** | |
| American Goldeneye | *Bucephala clangula* (L.) |
| Bufflehead | *Bucephala albeola* (L.) |
| Oldsquaw | *Clangula hyemalis* (L.) |
| Black Scoter | *Melanitta nigra* (L.) |
| White-winged Scoter | *Melanitta fusca* (L.) |
| Surf Scoter | *Melanitta perspicillata* (L.) |
| Common Eider | *Somateria mollissima* (L.) |
| Common Merganser | *Mergus merganser* (L.) |
| Red-breasted Merganser | *Mergus serrator* (L.) |
| Hooded Merganser | *Lophodytes cucullatus* (L.) |
| ***Tribe Oxyurini*** | |
| Ruddy Duck | *Oxyura jamaicensis* (Gmelin) |

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